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THE COMPARATIVE BIOLOGY
OF CROTALARIA SPECIES



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ABSTRACT

This thesis contains the results of a comparative study of the biology and ecology of Crotalaria spp. of which twenty-nine species have been recorded in Sri Lanka. Four of these species, viz., C. brownei, C. juncea, C. striata and C. verrucosa, were selected for detailed investigation.

The distribution of Crotalaria spp. in Sri Lanka was studied through multivariate analysis of floristic and environmental data collected from thirty communities selected to represent various climatic zones of the island. Association analysis was used to extract relatively homogeneous groups of communities from a heterogeneous body of floristic data. These groups appear to correspond with major climatic zones. Among the factors characterising various association-analysis groupings, rainfall, temperature, altitude and topography were found to be the most important. The within-group variation was studied by reciprocal averaging ordination which revealed that different Crotalaria spp. exhibit different distribution patterns within Sri Lanka. For instance, while C. striata occurs mainly in the lowlands of the wet zone, C. verrucosa occurs mainly in the lowlands of the dry zone. Again, C. brownei and C. laburnifolia which occur largely in higher altitudes are seldom found in the lowlands. The other species of Crotalaria usually show restricted distributions.

Each Crotalaria species shows specific habitat-partition within climatic zones. C. striata occurs more in habitats exposed to direct solar radiation than in shaded habitats. C. verrucosa is more frequent in exposed habitats with sandy soil. C. brownei appears to prefer moist habitats.

The within-community distribution of C. striata and C. verrucosa was studied by using variance, covariance and correlation analysis. C. striata occurs more on compact soil in hollows than on hummucks, while the reverse is true of C. verrucosa. Their micro-distribution is related to variations in edaphic factors, presumably moisture and nutrient regimes.

A detailed study was made of the seed biology of the four species of Crotalaria. Each species was found to produce several types of seeds distinguishable from colour of testa. The proportions of different seed types differed between inflorescences of the same plant, plants of the same population and also between populations. The between-plant differences may be related to genetic differences and within-plant differences may be a reflection of physiological differences.

The seed polymorphism is found to parallel polymorphism in germinability. Certain seed types were found to germinate readily while others remained dormant. The dormant seeds

germinated only after mechanical scarification, indicating that their testa could prevent hydration. In addition, external factors were found to influence germination, the most significant being moisture regime. Seeds require a continuous and adequate supply of water for unimpeded germination.

The vegetative growth-vigour differed between plants derived from different seed types as well as between species. These differences were manifested as differences in net assimilation rate and leaf area ratio. Of the external factors affecting growth, moisture and nutrient regimes were the most important. All four species of Crotalaria require favourable moisture for best growth. However, the resistance to moisture stress was higher in C. verrucosa than in the others. Cotyledons were also found to play a vital role during early growth of seedlings. Removal of cotyledons retarded growth. This retardation was higher when cotyledons are removed in earlier rather than in later stages of growth. Moreover, the removal of both cotyledons was more effective than the removal of one cotyledon.

In the concluding section of the thesis, the ecological implications of the major findings of the study are discussed briefly, and certain aspects worthy of further investigation are outlined.